

REMARKS

By this amendment, Applicants have amended claims 4 and 5 to more clearly define their invention. In particular, claims 4 and 5 have been amended to provide antecedent basis for the phrases “starting material carrying section” and “seed carrying section.” In addition, claim 4 has been amended to recite that each of the concave curved plane and the convex curved plane has a curvature radius of at least 1/10 of an inner diameter within the wall surface of the starting material carrying section. See, paragraph 0070 of Applicants’ specification. In addition the phrases “concave curved plane” and “convex curved plane” have been amended to read --concave curved surface-- and --convex curved surface--, respectively. Applicants have also amended the specification to provide antecedent basis for the phrases “concave curved surface” and “convex curved surface.” Applicants have canceled claims 9-19 without prejudice or disclaimer.

Claims 1-3 and 20 stand rejected under 35 U.S.C. 112, second paragraph. In support of this rejection, it has been urged by the Examiner that the surface roughness measurement “Rmax 6.4s” is unclear. Applicants traverse this rejection and request reconsideration thereof. As indicated in paragraph [0009] of Applicants’ specification, the surface roughness Rmax is the value according to JIS B0601-1982. The following is an English translation of section 3.4.3 of JIS B0601-1982:

3.4.3 Maximum value representation of the maximum height
To indicate the surface roughness by using
a permissible maximum value of the maximum height,

you should add “S” to the numeric number selected from the sequence of numbers listed in the Table 4.

Recital

1. The term “a permissible maximum value” here is the arithmetic mean value of multiple locations picked out at random from the designated surface, and is not the maximum value of each R_{max} .

2. Maximum value representation of the maximum Height, $3.2S$, for example, means “ $0 \mu m R_{max} \leq 3.2S \leq 3.2 \mu m R_{max}$.”

Thus, it would be clear to one of ordinary skill in the art, reading paragraph 0009 of Applicants’ specification and with knowledge of JIS B0601-1982, that the phrase “ $R_{max} 6.4s$ ” in claim 1 means a range between $0 \mu m R_{max}$ and $6.4 \mu m R_{max}$. Therefore, the phrase $R_{max} 6.4s$ is not indefinite.

Claims 1, 3, 4, 9-12, 20 and 21 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over U.S. Patent No. 5,830,269 to Kawase et al. in view of U.S. Patent Application Publication No. 2003/0089299 to Obara et al. Applicants traverse this rejection and request reconsideration thereof.

Claims 1-3 and 20 relate to a crucible for growth of a single crystal along the crystal plane of a seed by melting and cooling an optical part material. According to claims 1-3 and 20, the surface roughness of the inner surface of the crucible as measured by the maximum height method is no greater than $R_{max} 6.4s$. As noted above, the phrase $R_{max} 6.4s$ means that the surface roughness as measured by the maximum height method is in the range of 0 to $6.4 \mu m R_{max}$.

The patent to Kawase et al. discloses a method for preparing Group II-VI or III-V compound single crystals. The method includes steps of coating an inner surface a crucible with a film consisting of powdered solids in a vitreous

substance, placing a polycrystalline compound in the coated crucible, placing the crucible in a furnace, heating the crucible with the furnace for melting the polycrystalline compound in the crucible, and cooling the crucible and the melting compounds for growing a single crystalline compound. Additionally, the surface of the seed crystal and a gap between the seed crystal and a wall of the crucible may also be coated with a film of powdered solids or a vitreous substance. At column 4, lines 61-64 of this patent, it is disclosed that the surface roughness of the inner surface of the crucible is a maximum surface roughness R_{max} according to JIS B 0601-1994 of preferably 10 to 150 μm , and an arithmetical mean roughness R_a of preferably 3-15 μm . Thus, this patent does not disclose a crucible in which the surface roughness of the inner surface of the crucible is measured by the maximum height method is no greater than R_{max} 6.4s, i.e., no greater than 6.4 μm R_{max} , as presently claimed.

The Obara et al. publication discloses an optical member for photolithography used together with light having a wavelength of not more than 250 nm. However, nothing in Obara et al. remedies any of the deficiencies noted above with respect to Kawase et al. Accordingly, claims 1-3 and 20 are patentable over Kawase et al. and Obara et al.

Claims 4 and 21 relate to a crucible in which a tapered cone surface is formed between the starting material carrying section in which the starting material is loaded and the seed carrying section in which the seed is loaded. According to claim 4, a wall surface of the starting material carrying section is smoothly connected to the cone surface via a concave curved surface and the

cone surface is smoothly connected to the wall surface of the seed carrying section via a convex curved surface. Each of the concave curved surface and the convex curved surface has a curvature radius of at least $1/10$ of an inner diameter within the wall of the surface of the starting material carrying section.

While the outstanding Office Action alleges that the Kawase et al. patent to disclose a crucible in which a wall surface of the starting material carrying section is smoothly connected to the cone surface via a concave curved plane and the cone surface is smoothly connected to the wall surface of the seed carrying section via a convex curved plane, this does not appear to be the case. It does not appear that the wall surface of the starting material carrying section is smoothly connected to the cone surface via a concave curved surface or that the cone surface is smoothly connected to the wall surface of the seed carrying section via a convex curved surface; rather, it appears there is no curved surface at all between the tapered section 1b and the opening portion 1a or between the tapered section 1b and the seed receiving portion 1c in Kawase et al. Clearly, the Kawase et al patent does not disclose a wall surface of the starting material carrying section is smoothly connected to the cone surface via a concave curved plane and the cone surface is smoothly connected to the wall surface of the seed carrying section via a convex curved plane, wherein each of the concave curved plane and the convex curved plane has a curvature radius of at least $1/10$ of an inner diameter within the wall surface of the starting material carrying section, as now set forth in claim 4.

Nothing in Obara et al. remedies any of the deficiencies noted above

with respect to Kawase et al. Accordingly, claims 4 and 21 are patentable over Kawase et al. and Obara et al.

Claim 2 stands rejected under 35 U.S.C .103(a) as allegedly being unpatentable over Kawase et al. in view of Obara et al and further in view of U.S. Patent No. 5,476,679 to Lewis et al. Applicants traverse this rejection and request reconsideration thereof.

The Lewis et al patent has been cited by the Examiner for its teachings in connection with the material of which the crucible is made. However, clearly nothing in Lewis et al remedies any of the deficiencies noted above with respect to Kawase et al and Obara et al. Accordingly, claim 2 is patentable over Kawase et al., Obara et al. and Lewis et al at least for the reasons noted above.

Claims 5 and 22 stand rejected under 35 U.S.C .103(a) as allegedly being unpatentable over U.S. Patent No. 4,946,544 to Ejim in view of Obara et al. Applicants traverse this rejection and request reconsideration thereof.

Claims 5 and 22 are directed to a crucible in which the cone angle of the tapered cone surface formed between the starting material carrying section in which the starting material of said optical part material is loaded and the seed carrying section in which said seed is loaded is set in a range between 95° and 150°.

The Ejim patent discloses a crucible having a generally cylindrical major portion M, a frustoconical transition portion T, and a cylindrical seed well portion S, that is arranged vertically with the seed well portion at the bottom. Contrary to the assertion in the office action, the Ejim patent does not

disclose the cone angle of the frustoconical transition portion T. The portion of Ejim to which the Examiner refers discloses that three sets of "friendly" twins which exit the crystal on the same side from which they initiated were usually present at 120 degree apart in the $\langle 111 \rangle$ crystal grown in the usual manner but that ten of the eleven ingots grown with solid phosphorus added directly to the charge did not exhibit these three sets of twins. The disclosure of the angles between the sets of "friendly" twins does not suggest the cone angle of the frustoconical transition portion T. Thus the Ejim patent does not disclose a crucible in which the cone angle of the tapered cone surface formed between the starting material carrying section in which the starting material of said optical part material is loaded and the seed carrying section in which said seed is loaded is set in a range between 95° and 150°.

Nothing in Obara et al. remedies any of the deficiencies noted above with respect to Ejim. Accordingly, claims 5 and 22 are patentable over Ejim and Obara et al.

Claims 6, 8 and 23 stand rejected under 35 U.S.C .103(a) as allegedly being unpatentable over U.S. Patent No. 5,169,486 to Young et al in view of Obara et al. Applicants traverse this rejection and request reconsideration thereof.

Claims 6, 8 and 23 relate to a crucible characterized in that the contact angle between the crucible inner surface and water droplets is no greater than 100°.

The Young et al patent discloses in Figure 3 a crucible 300 that comprises a seed well 301, a first transition region 302, a stable growth region

303, a second transition region 304, and a major growth region 305. Seed well 301 and transition region 302 correspond in function, respectively, to seed well 203 and transition region 202 of FIG. 2. The conical first transition region 302 is disclosed to have an included angle of 90 degrees and a diameter of approximately 2 inches at its top. The cylindrical stable growth region 303 may have a constant diameter or it may be tapered outwardly in the direction of crystal growth. The disclosure of the included angle of 90 degrees of the conical first transition region 302 does not suggest that the contact angle between the crucible inner surface and water droplets is no greater than 100°. Therefore the Young et al patent does not disclose the presently claimed invention.

Nothing in Obara et al. remedies any of the deficiencies noted above with respect to Young et al. Accordingly, claims 6, 8 and 23 are patentable over Young et al and Obara et al.

Claim 7 stands rejected under 35 U.S.C .103(a) as allegedly being unpatentable over Young et al. in view of Obara et al and further in view of Lewis et al. Applicants traverse this rejection and request reconsideration thereof.

The Lewis et al patent has been cited by the Examiner for its teachings in connection with the material of which the crucible is made. However, clearly nothing in Lewis et al remedies any of the deficiencies noted above with respect to Young et al and Obara et al. Accordingly, claim 7 is patentable over Young et al., Obara et al. and Lewis et al at least for the reasons noted above.

In view of the cancellation of claims 9-19, the rejections of these claims are moot.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance of all the claims now in the application are requested.

Please charge any shortage in the fees due in connection with the filing of this paper, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 1303.45694X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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